Small Business Innovation Research/Small Business Tech Transfer

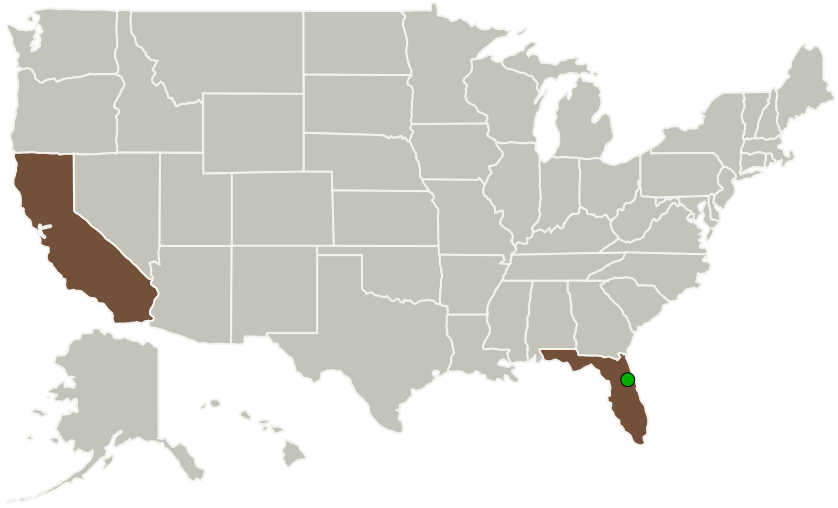
Small Body Regolith Extraction System, Phase I

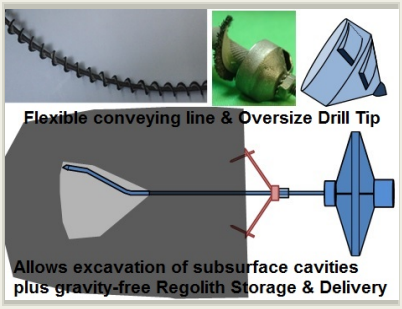
Completed Technology Project (2015 - 2015)

Project Introduction

This project will develop a specialized flexible microgravity subsurface drilling and regolith extraction system which could extract significant quantities of regolith from depths between 1m and 3m below the surface through a small (~2.6cm diameter) entrance drill hole. Such a drill system could selectively extract just the fine-fraction of regolith from depths which have not been exposed to significant space-weathering (e.g. by utilizing its unique oversize-particle-rejecting drill-head feeder). The flexible drill system could be utilized to create horizontal wells for direct insitu extraction of volatiles on the moon, for instance, without removing the bulk of the regolith (e.g. see Walton et al 2014a, b) or it could excavate subsurface volumes of regolith of the order of 0.5m3 through a single small entrance hole, for small body applications. If the near-surface regolith on a small body is primarily comprised of small particulates, with say at least 70% by mass being particles smaller than 2mm, then such a system could create a subsurface excavation on the order of 0.3m3 to 0.4m3 during a sunlit operating time duration of less than 100hrs (assuming the bulk density of the regolith is on the order of 1g/cc). Microgravity capable storage and transfer vessels and conveying lines (demonstrated in previous phase-1 SBIR projects, Walton et al 2012; 2014) could be utilized to store, dispense, or transfer the material in continuous or batch modes to other equipment for processing (i.e., the microgravity storage vessels could act as a buffer volume to provide a uniform rate of delivery for a continuous process, or they could dispense material in batches, as needed). The entire regolith extraction system is enclosed with minimal loss of volatiles and no extraneous debris after initiation of the drill-hole.

Primary U.S. Work Locations and Key Partners





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Completed Technology Project (2015 - 2015)

Organizations Performing Work	Role	Type	Location
Grainflow Dynamics, Inc.	Lead Organization	Industry	Livermore, California
Kennedy Space Center(KSC)	Supporting Organization	NASA Center	Kennedy Space Center, Florida

Primary U.S. Work Locations	
California	Florida

Project Transitions

June 2015: Project Start

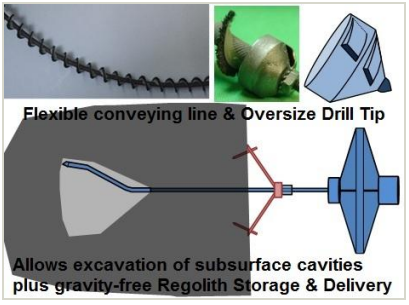
December 2015: Closed out

Closeout Summary: Small Body Regolith Extraction System, Phase I Project I mage

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/139464)*

Images



Briefing Chart Image
Small Body Regolith Extraction System, Phase I
(https://techport.nasa.gov/image/136424)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Grainflow Dynamics, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

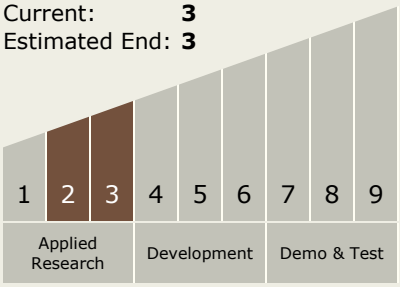
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Otis R Walton

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Small Body Regolith Extraction System, Phase I

Completed Technology Project (2015 - 2015)

Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.2 Resource Acquisition, Isolation, and Preparation

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System